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Mourning Dove

Breeding Population Status, 1990

Department of the Interior

U.S. Fish & Wildlife Service

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MOURNING DOVE BREEDING POPULATION STATUS, 1990

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Abstract: This report includes Mourning Dove Call-Count Survey information gathered over the last 25 years. Trends were calculated for the most recent 2 and 10-year intervals and for the entire 25-year period. Between 1989 and 1990, the number of doves heard per route showed no significant change in the 3 management units. Estimates indicated significant downward trends in the Western Unit for the 10 and 24-year periods. No significant trend was found in the Eastern or Central Units for either time frame. Trends for doves seen at the unit level over the 10 and 25-year periods agreed with trends for doves heard.

The mourning dove (*Zenaida macroura*) is a migratory bird, thus, authority and responsibility for its management is vested in the Secretary of the Interior. This responsibility is delegated by the Migratory Bird Treaty Act of 1918 which, as amended, implements migratory bird treaties between the United States and other countries. Mourning doves are included in the treaties with Great Britain (for Canada) and Mexico. As one of the most abundant species in both urban and rural areas of North America, it is familiar to millions of people who enjoy its presence each day. Maintenance of mourning dove populations in a healthy, productive state is a primary management goal. To this end, management of doves includes assessment of population status, regulation of harvest, and habitat management. Call-count surveys are conducted annually in the 48 conterminous states by state and federal biologists to monitor mourning dove populations and aid wildlife administrators in setting annual hunting regulations.

Distribution and Abundance

The breeding range of the mourning dove includes the 48 conterminous states, the southern portions of the Canadian Provinces, the Greater Antilles, and Mexico (Fig. 1). Two subspecies occur within the United States (Aldrich and Duvall 1958). *Z. m. marginella* is found in the western two-thirds of the nation, while *Z. m. carolinensis* occupies the eastern portion. A zone of overlap contains an intermediate form of the 2 races.

The mourning dove is one of the most widely distributed and abundant birds in North America (Robbins et al. 1986, Fig. 1). Although not known precisely, the fall population has been estimated to be about 475 million (Dunks et al. 1982, Tomlinson et al. 1988).

Population Monitoring

The Mourning Dove Call-Count Survey was developed to provide an annual index to population size. This survey is based on work by McClure (1939) in Iowa. Field studies demonstrated the feasibility of the survey as a method for detecting annual changes in mourning dove breeding populations (Foote and Peters 1952). The first nationwide survey was conducted in 1953 with routes selected in areas of high dove densities. Between 1957 and 1966, the original routes, which did not provide a representative sample of the dove population, were replaced by randomly selected routes, stratified by physiographic regions (Foote et al. 1958). The survey currently includes more than 1,000 routes. Only randomized routes run since 1966 were included in the analyses for this report. The total number of doves heard on each route is used to determine trends in population size and provides the basis for determining an index to population size during the breeding season. Indices for doves seen are also presented in this report, but

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The primary purpose of this report is to facilitate the prompt distribution of timely information. Results are preliminary and may change in the final analysis with the inclusion of additional data.

Artist Joe Garcia and Wild Wings, Inc., Lake City, Minnesota, provided the cover art for this report.

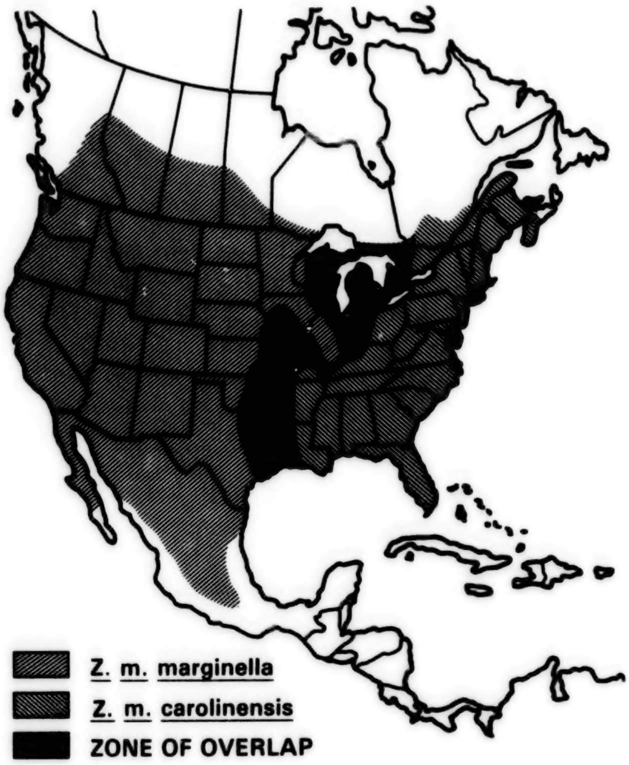

Fig. 1. Breeding range of the mourning dove (Wetmore 1956; Aldrich and Duvall 1958; Godfrey 1966; Lack 1976; Leopold 1972; Salt and Salt 1976; Armstrong 1977; Caron et al. 1986; Breeding Bird Survey files, USFWS).

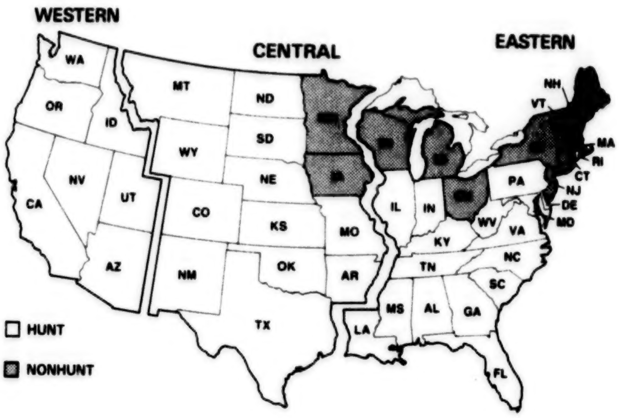

Fig. 2. Mourning dove management units with 1989 hunting and nonhunting states.

only as supplemental information for comparison with doves heard. Even though both the numbers of doves heard and seen are counted during the survey, each count represents an independent sample.

Within the United States, there are 3 zones which contain mourning dove populations that are largely independent of each other (Kiel 1959). These zones encompass the principal breeding, migration, and U.S. wintering areas for each population. As suggested by Kiel (1959), these 3 areas were established as separate management units in 1960 (Kiel 1961). Since that time, management decisions have been made within the boundaries of the Eastern (EMU), Central (CMU), and Western (WMU) Management Units (Fig. 2).

The Eastern Unit was further divided into 2 groups of states for analyses. States permitting dove hunting were combined into one group and those prohibiting dove hunting into another. Dove hunting in Indiana was first permitted in 1984, but this state was considered as a nonhunting state in the analyses to provide comparability in determining long-term population trends.

In a separate analysis, the WMU and CMU were divided into separate geographic reference areas as adopted by Dunks et al. (1982) and Tomlinson et al. (1988) (Fig. 3). These north-south oriented tiers contain similar dove migration patterns. Separation of states in the EMU was not considered at this time. The reference areas are herein referred to as Coastal WMU, Interior WMU, West CMU, Mid CMU, and East CMU. In this analysis, Nevada was grouped with the interior states of the WMU rather than the coastal states as indicated in the aforementioned publications because of a greater similarity in dove populations with the interior states.

METHODS

The Call-Count Survey

Each call-count route is usually located on lightly traveled secondary roads and has 20 listening stations spaced at 1-mile intervals. At each stop, the number of doves heard calling, the number seen, and the level of disturbance (noise) which impairs the observer's ability to hear doves are recorded. The number of doves seen while driving between stops is also noted.

Counts begin one-half hour before sunrise and continue for about 2 hours. Routes are run once between May 20 and June 5. Intensive studies in

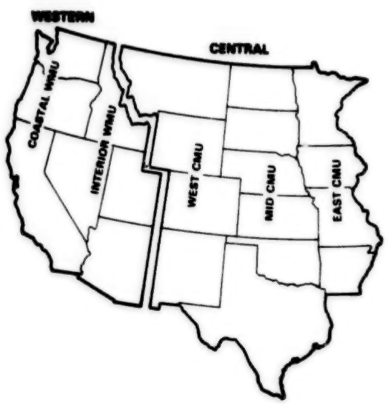

Fig. 3. Geographic reference areas in the Western and Central Management Units.

the eastern United States (Foote and Peters 1952) indicated that dove calling is relatively stable during this period. Surveys are not made when wind velocities exceed 12 miles per hour or when it is raining.

Estimation of Population Trends

The estimation of trends in dove abundance provides important information for the management of mourning doves. Trend data are reviewed each year prior to establishing annual hunting regulations. A population trend is defined as the ratio of the dove population in an area in one year to the population in the preceding year. The trend is expressed as an average annual rate of change. For this report, data were analyzed using the route regression method (Geissler 1984). A trend was first estimated for each route using a linear regression on a logarithmic scale. Because many routes have been run by different observers over time, the average trend for each route was estimated with a regression model that considered individual observers and their differing abilities to hear and see doves. The slope is an estimate of the trend of each route and provides a measure of the rate of annual population change in the presence of annual variations or longer term fluctuations in the counts. State and management unit trends were obtained by calculating a mean of all route trends weighted by land area, within-route variance in counts, and density (mean numbers of doves on each route). In earlier reports, route trends were weighted by number of routes in physiographic regions to form trends for states and larger regions.

Following a recent statistical review, we have eliminated this weighting by sample size which has resulted in small changes in magnitude of trend estimates in certain states. Variances of state and management unit trends were estimated by using route trends and statistical procedures known as bootstrapping (Geissler 1984).

The route regression method was used to estimate the annual change or trend for each area in doves heard over the most recent 2 and 10-year intervals and for the entire 25-year period. Additionally, the trend in doves seen was estimated over a 25-year period as supplemental information for comparison. For purposes of this report, statistical significance is defined as $P<0.05$, except for the 2-year comparison where $P<0.10$ was used because of the low power of the test. Significance levels are approximate for states with less than 10 routes.

Estimation of Annual Indices

Annual indices show population fluctuations about fitted trends (Geissler 1984). The estimated indices were determined for an area (state or management unit) by finding the deviation between observed counts on a route and those predicted on the route from the area trend estimate. These residuals were averaged by year for all routes in an area and added to the fitted trend for the area to produce the annual index of abundance. This method of finding indices superimposes yearly variation in counts on the long-term fitted trend. These indices should provide an accurate representation of the fitted trend for regions that are adequately sampled by survey routes. Additionally, only data from within an area are incorporated into the area's index. At least at the unit level, the patterns of change from year-to-year produced by this method are similar to those of previous index techniques used earlier in this report series. Since the indices are adjusted for observer differences and trend, the index for an area may be quite different from the actual count. The percent change per year estimated from the trend analysis may differ due to chance from the percent change per year calculated directly from the breeding population indices. The percent change estimated from the trend analysis is the appropriate statistic to consider because this percent change is estimated directly from comparable route data, and statistical significance can be assessed for the trend estimate.

In a separate analysis, the mean number of doves heard calling per route for the 1986-90 period was

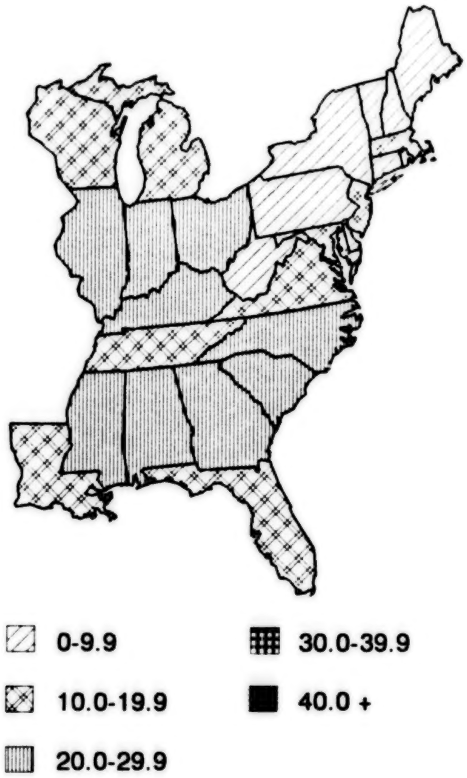

Fig. 4. Mean number of mourning doves heard per route by state in the Eastern Management Unit, 1986-90.

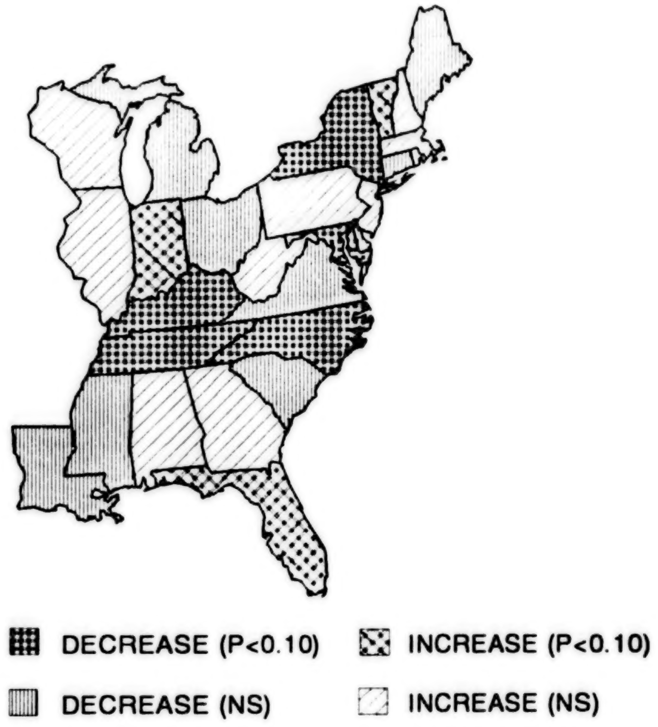

Fig. 5. Changes in number of mourning doves heard per route by state in the Eastern Management Unit, 1989-90.

calculated for each state. In contrast to the estimated annual index, which illustrates population changes over time, the estimated densities illustrate the actual numbers of doves present over the most recent 5 years.

RESULTS

Eastern Management Unit

The Eastern Management Unit includes 27 states, comprising 30% of the land area of the United States. Dove hunting is permitted in 17 states, representing 70% of the land area of the Unit.

1986-90 Population Distribution.--Nine states had a mean number of 20-30 mourning doves heard per route over the 5-year period (Fig. 4). Included were Illinois, Indiana, Ohio, Kentucky, Mississippi, Alabama, Georgia, and North and South Carolina. Low densities (less than 10 per route) were in Maine, New Hampshire, Vermont, New York, Connecticut, Pennsylvania, West Virginia and Delaware. Densities are normally low in these areas.

1989 to 1990 Population Changes.--The 1990 population was not significantly different from the 1989 population in the Unit or in the combined hunting and combined nonhunting states (Table 1). The number of doves heard per route increased in the Unit by 0.2% and in the nonhunting states by 0.5% (Table 1). In the hunting states, the average remained essentially unchanged. Annual indices (Table 2), which display year-to-year changes in the context of long-term trends, generally show population changes similar to those predicted by the route regression analysis. The 2 estimates of trend may not always agree as a consequence of weighting of the route-regression trend estimate and the inherent variability in call-count data.

The population level increased significantly in Vermont, Indiana, and Florida (Fig. 5, Table 1). A significant decrease was found in New York, Maryland, Kentucky, Tennessee, and North Carolina.

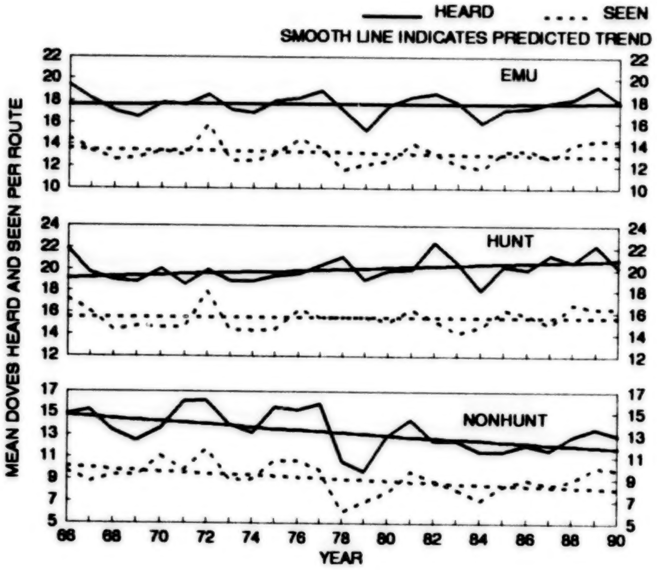

Fig. 6. Population indices of breeding mourning doves in the Eastern Management Unit, 1966-90.

Population Trends: 10 and 25-year.--The 1990 population index of 17.8 doves heard for the Unit is the same as the predicted counts based on the long-term estimates (Fig. 6, Table 2). In the nonhunting states, the index of 13.0 is above the predicted estimate of 11.8, while in the hunting states, the index of 20.2 is slightly below the predicted counts.

Estimates indicated no significant trends in numbers of doves heard for the Unit or combined hunting states for the 10 and 25-year periods between 1966-90 (Table 1). A plot of the annual indices both for doves heard and seen shows a similarity in pattern between the 2 counts (Fig. 6). An analysis of doves seen also indicated no significant trends for either time period. In contrast to both the CMU and WMU, average numbers of doves seen in the Eastern Unit are lower than doves heard for all years.

There was an upward trend in doves heard in the nonhunting states over the most recent 10 years, but no trend was indicated over 25 years (Table 1). The same results were found for doves seen over the 2 intervals.

Trend statistics by state are shown in Figure 7 (25-year period) and Table 1 (10 and 25-year intervals). A significant increase in numbers of doves heard was indicated in Wisconsin and Ohio (10 years), and Maine and Florida (25 years). Significant downward trends were found in Alabama, South Carolina, and New York between 1981 and 1990. Between 1966 and 1990, downward trends were noted in Indiana and Maryland.

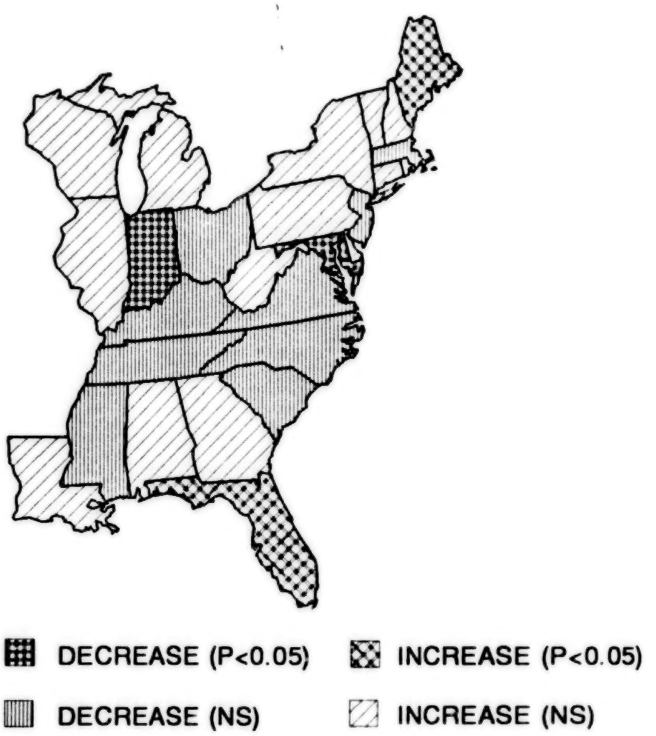

Fig. 7. Trends in number of mourning doves heard per route by state in the Eastern Management Unit, 1966-90.

Central Management Unit

The Central Management Unit consists of 14 states, containing 46% of the land area in the U.S. The CMU has the highest population index of the 3 Units. Within the Central Unit, dove hunting is permitted in 12 states.

1986-90 Population Distribution.--North Dakota, South Dakota, and Kansas had the highest dove population densities in the nation with more than 40 doves heard per route, on average, over the 5-year period (Fig. 8). Nebraska had more than 30 doves per route.

1989 to 1990 Population Changes.--No significant change occurred in the population between 1989 and 1990 in the CMU. The number of doves heard per route increased 4.2% (Table 1). Year-to-year

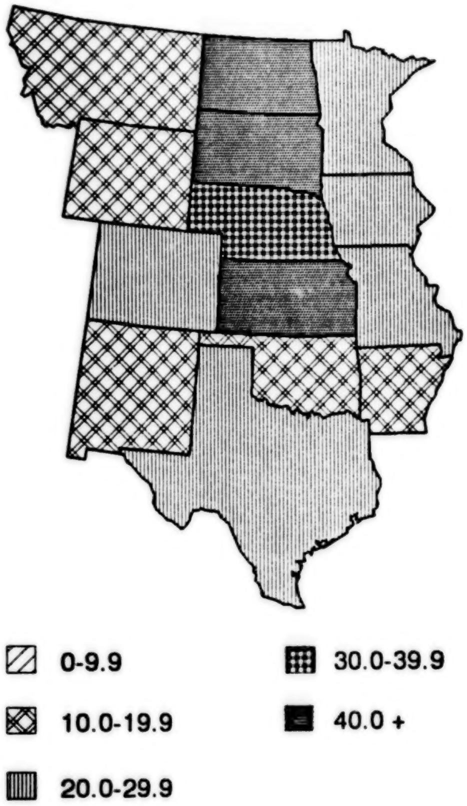

Fig. 8. Mean number of mourning doves heard per route by state in the Central Management Unit, 1986-90.

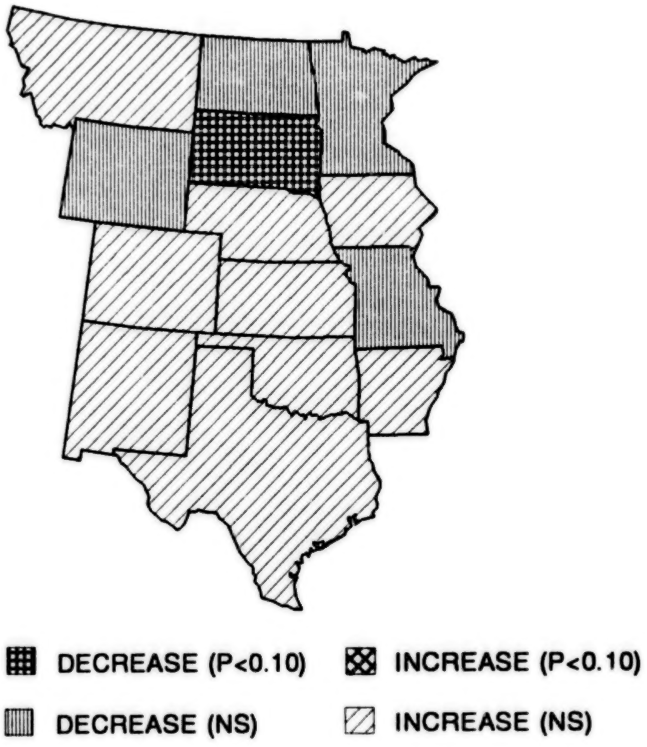

Fig. 9. Changes in number of mourning doves heard per route by state in the Central Management Unit, 1989-90.

changes in the context of long-term trends are shown by annual indices in Table 2.

No significant changes in doves heard occurred between the 2 years in any of the 3 CMU reference areas (Table 3). The index increased 5.8% and 4.9% in the West and Mid CMU, respectively. There was a decrease of 0.3% in the East CMU.

The population level decreased significantly in South Dakota (Fig. 9, Table 1). No significant change was found in any of the other states over the interval.

Population Trends: 10 and 25-year.--The 1990 index for the unit of 23.4 doves heard per route is at the predicted long-term trend estimate (Fig. 10, Table 2).

No significant trend was indicated for the Unit over either of the 2 time periods (Table 1). The same results were obtained by analyzing the number of doves seen. Average numbers of doves seen in the CMU have been consistently higher than doves heard (Fig. 10).

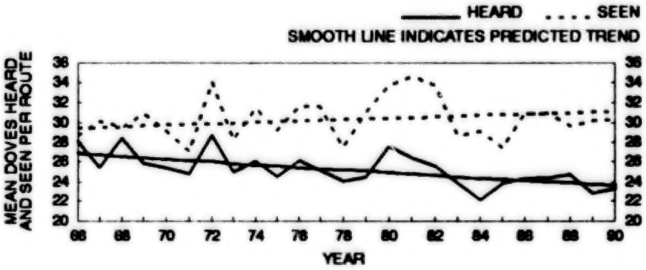

Fig. 10. Population indices of breeding mourning doves in the Central Management Unit, 1966-90.

In the West CMU, no significant trend was found for either interval (Table 3). The Mid CMU showed no trend over 25 years, but a downward trend was observed over the most recent 10 years. The East CMU showed a decline over the long term but a more stable population between 1981-90. Trends in doves seen by tier over the 2 periods paralleled the results for doves heard.

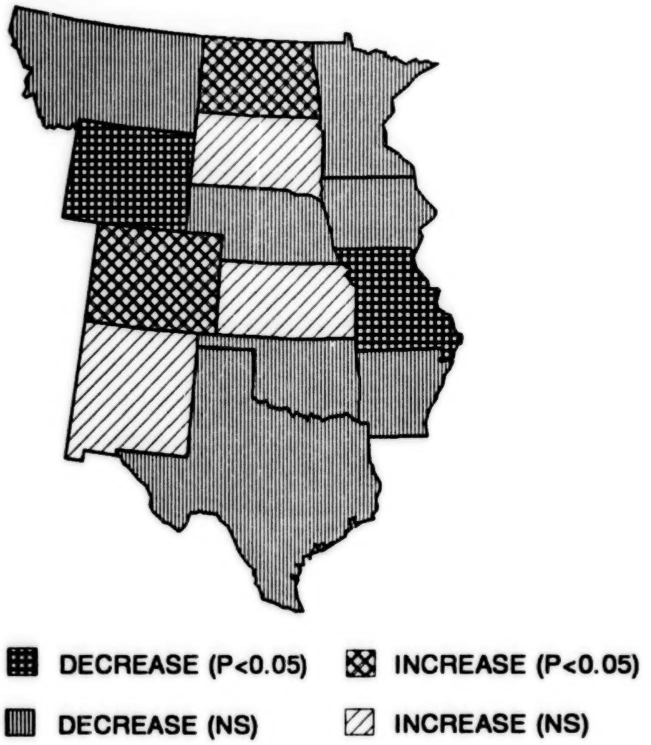

Fig. 11. Trends in number of mourning doves heard per route by state in the Central Management Unit, 1966-90.

State trends over 25 years are illustrated in Figure 11. A positive trend was found in North Dakota and Colorado, while Wyoming and Missouri had negative trends. Colorado, however, showed a downward trend over the most recent 10 years (Table 1) as did Nebraska and Arkansas.

Western Management Unit

Seven states comprise the Western Management Unit and represent 24% of the land area in the U.S. All states within the Unit permit hunting.

1986-90 Population Distribution.--California and Arizona had an average of 10-20 doves heard per route over the period (Fig. 12). The other 5 states in the Unit averaged less than 10 birds per route.

1989 to 1990 Population Changes.--The population for the Unit did not change significantly between the 2 years although the number of doves heard per route declined 4.9%. In Oregon, the number of birds heard increased significantly whereas, in Nevada, the number decreased (Fig. 13).

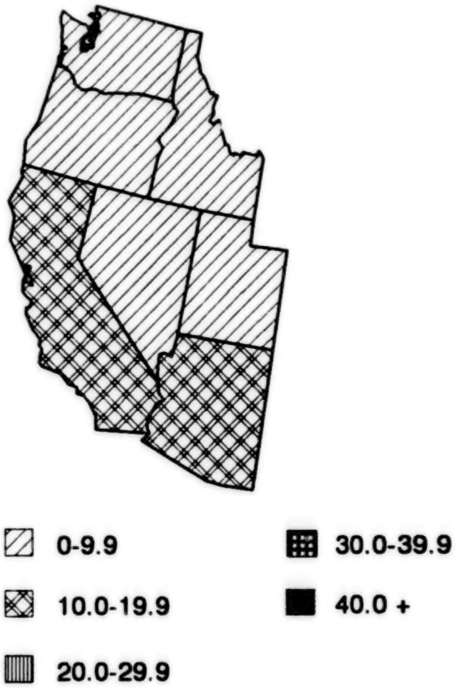

Fig. 12. Mean number of mourning doves heard per route by state in the Western Management Unit, 1986-90.

A significant decrease was also found in doves heard in the Interior WMU (Table 3). Although the index increased in the Coastal WMU, there was no statistically significant difference in the counts between the 2 years.

Population Trends: 10 and 25-year.--The 1990 index of 9.4 doves heard per route is slightly above the predicted count based on the long-term estimate (Fig. 14).

Estimates indicated significant downward trends in numbers of doves heard for the Unit, Coastal WMU, and Interior WMU during both the 10 and 25-year time periods between 1966 and 1990 (Tables 1 and 3). Analyses of doves seen gave the same results. The indices for doves heard and seen have similar patterns from 1966-90 (Fig. 14).

California showed decreasing numbers of doves heard for the 10 and 25-year intervals (Table 1). A downward trend was also found in Arizona during the most recent 10 years and in Washington and Oregon for the 25-year period. Trends for the 1966-90 interval are illustrated in Figure 15.

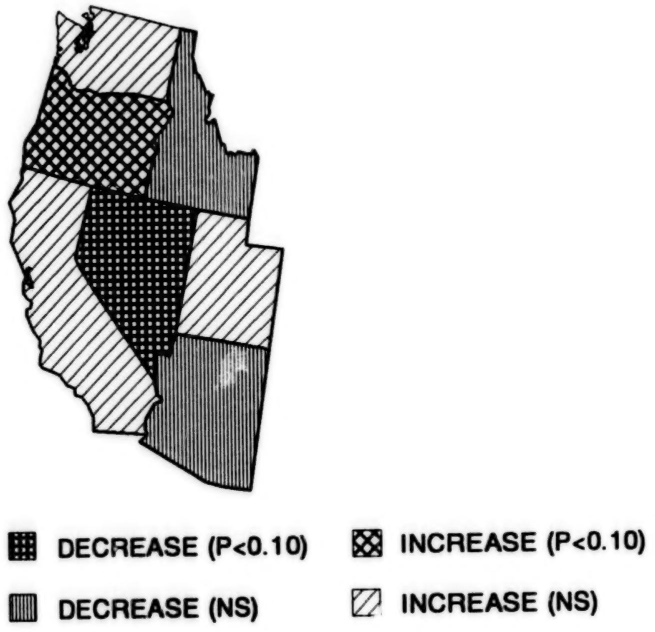

Fig. 13. Changes in number of mourning doves heard per route by state in the Western Management Unit, 1989-90.

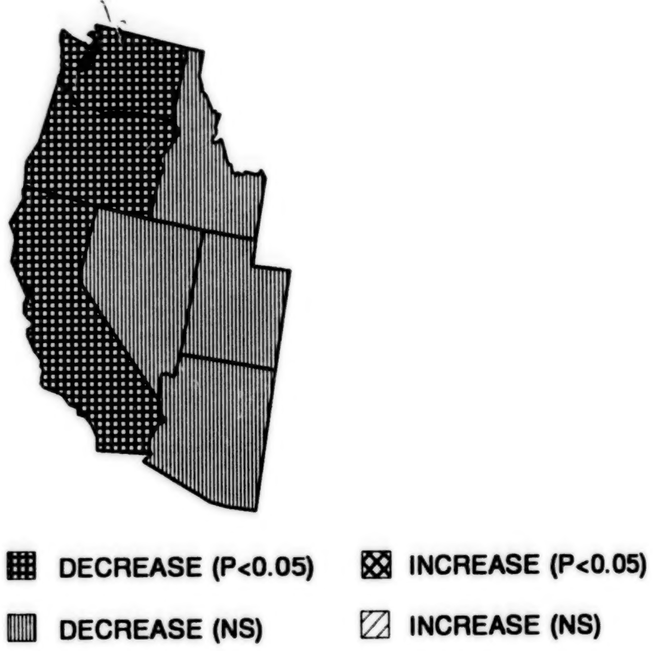

Fig. 15. Trends in number of mourning doves heard per route by state in the Western Management Unit, 1966-90.

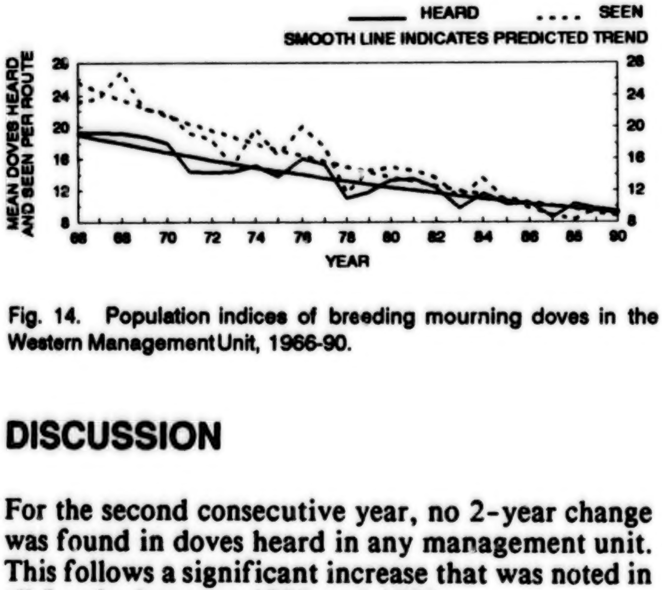

Fig. 14. Population indices of breeding mourning doves in the Western Management Unit, 1966-90.

DISCUSSION

For the second consecutive year, no 2-year change was found in doves heard in any management unit. This follows a significant increase that was noted in all 3 units between 1987 and 1988.

Declining long-term trends are cause for concern in the Western Management Unit and other areas. Dolton (1989) reviewed investigations concerning habitat and agricultural changes that may have been detrimental to dove populations in some areas.

In most instances, it is difficult to pinpoint exact causes of declines in dove abundance. We believe that a combination of factors involving both mortality (natural and hunting related) and reproduction (habitat related) is responsible.

We are hopeful that the restrictive mourning dove hunting regulations, in place since 1987 in the WMU, will stabilize populations in that Unit. In 1991, estimates will be made of 5-year trends both before and after the regulations change to determine if the modification had any effect on population levels. We feel that a minimum of 5 years of data is necessary to adequately assess trends.

To more fully understand the role of hunting on mourning dove populations, the Central Management Unit Migratory Shore and Upland Game Bird Technical Committee initiated a study in Missouri in 1989. FIeld work addressing this question and others began in the spring of 1990 and will continue until the fall of 1991. A final report is scheduled for June 1992. This study has been funded to date by contributions from 13 Central and Eastern Management Unit states and the U.S. Fish and Wildlife Service.

State wildlife agencies are encouraged to examine available data on dove populations and dove harvest to determine the degree to which these local situations differ from those indicated at the management unit level. Individual states may choose more restrictive hunting regulations than those offered to the management unit.

ACKNOWLEDGMENTS

Personnel of state wildlife agencies and the U.S. Fish and Wildlife Service cooperated in collecting the data presented in this report. J.R. Sauer developed the method for calculating annual indices, refined route regression programs for data analyses, and provided computer and statistical support. H.C. Bourne performed computer processing services. M.A. McKeogh provided secretarial support. R.J. Blohm, R.I. Smith, and J.R. Sauer reviewed the manuscript and provided helpful comments and suggestions.

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Table 1. Trends (% change[a] per year as determined by linear regression) in number of mourning doves heard along call-count survey routes, 1966-90.

Management unit/state	2 year (1989-90)					10 year (1981-90)					25 year (1966-90)				
	N	% Change		95% CI		N	% Change		95% CI		N	% Change		95% CI	
EASTERN UNIT															
Hunt															
AL	23	1.6		-19.9	24.3	33	-4.2	**[b]	-7.9	-0.6	40	1.0		-0.4	2.4
DE	2	-17.2		-73.2	14.1	3	19.3		-5.5	34.9	3	7.5		-5.7	19.6
FL	19	23.7	*	-4.7	52.9	26	2.4		-3.1	8.7	30	2.8	**	0.5	4.8
GA	20	4.5		-12.6	22.2	22	-1.8		-4.3	0.5	26	0.3		-1.4	1.8
IL	15	16.4		-14.6	48.4	22	2.9	*	-0.4	6.4	22	2.0		-0.7	4.3
KY	15	-30.8	***	-43.4	-16.6	21	-0.3		-4.8	4.0	25	-0.9		-4.1	2.1
LA	17	-7.4		-20.2	6.2	20	-0.8		-3.6	2.0	23	0.4		-1.6	2.3
MD	8	-35.7	***	-53.7	-18.2	14	-2.0		-6.1	2.2	16	-2.7	**	-5.1	-0.3
MS	19	-10.6		-27.3	7.0	26	-0.6		-5.4	4.2	28	-0.9		-4.2	2.8
NC	19	-14.4	***	-22.9	-6.3	24	0.8		-2.1	3.8	24	-1.8	*	-3.8	0.3
PA	13	11.9		-37.2	61.5	16	-1.9		-5.4	1.9	17	0.3		-2.3	2.8
RI	2	23.6		-26.2	88.2	2	-1.7		-7.2	3.9	5	1.6		-14.5	21.0
SC	14	-6.5		-24.1	11.8	24	-3.2	**	-5.9	-0.4	25	-0.2		-2.9	2.5
TN	18	-11.1	*	-24.3	1.5	25	-0.5		-3.8	2.5	31	-1.6	*	-3.6	0.2
VA	25	-16.2		-34.3	4.4	32	-0.1		-3.6	3.3	32	-2.1		-5.1	0.8
WV	9	13.4		-14.5	48.9	9	4.2		-3.9	17.0	11	4.5		-1.4	8.6
Subunit	238	0.0		-8.0	7.9	319	-0.6		-2.2	1.0	358	0.4		-0.9	1.6
Nonhunt															
CT	2	-5.7		-51.0	35.4	2	-1.1		-17.1	15.5	2	9.9		-5.5	28.4
IN[c]	9	22.6	*	-0.7	45.4	15	2.5	*	0.0	5.2	17	-2.8	***	-4.4	-1.2
ME	8	-14.2		-42.4	16.9	10	-0.7		-8.7	8.7	12	8.6	**	0.5	16.7
MA	7	3.9		-42.2	43.9	19	-3.4		-8.5	2.3	19	-1.1		-5.4	3.2
MI	14	-0.5		-31.4	31.5	20	5.6	*	-0.3	12.3	20	0.6		-4.1	5.4
NH	2	41.2		-10.6	105.8	8	-4.2		-20.6	7.1	13	0.0		-15.6	10.4
NJ	9	4.5		-35.9	43.2	18	0.0		-3.1	2.7	19	-2.2		-5.1	1.0
NY	11	-29.9	*	-43.0	3.0	17	-4.0	***	-6.6	-1.1	19	1.0		-2.7	5.5
OH	16	-17.3		-47.2	16.3	52	4.1	***	1.2	6.9	55	-1.7	*	-3.5	0.0
VT	17	33.9	**	0.9	69.7	21	4.2		-2.8	11.7	23	4.4		-2.4	11.7
WI	15	7.5		-19.7	37.3	22	3.8	**	0.8	6.9	22	0.6		-1.2	2.4
Subunit	110	0.5		-14.1	15.8	204	3.4	***	1.5	5.4	221	-0.9		-2.7	0.8
Unit	348	0.2		-6.6	7.5	523	0.3		-1.1	1.7	579	0.1		-1.1	1.2
CENTRAL UNIT															
AR	12	1.9		-25.4	29.4	15	-3.8	***	-7.0	-1.5	16	-2.7	*	-6.1	0.4
CO	16	0.8		-25.5	27.3	16	-2.6	**	-4.9	-0.4	19	4.3	***	1.9	6.7
IA	13	5.6		-20.0	31.9	17	-0.1		-3.1	3.5	17	-1.1		-2.3	0.2
KS	20	4.2		-15.0	25.7	28	-1.3		-5.1	2.4	31	0.3		-1.3	2.0
MN	8	-1.6		-37.7	35.3	13	-2.4		-5.8	1.2	14	-0.5		-3.7	3.2
MO	15	-7.3		-29.1	14.4	22	-1.3		-3.6	1.3	26	-3.2	***	-5.8	-0.9
MT	15	11.1		-17.6	39.1	25	0.3		-7.7	9.2	28	-0.6		-4.8	3.6
NE	24	1.6		-20.5	26.6	25	-3.4	**	-6.3	-0.7	26	-0.6		-1.9	0.8
NM	21	17.4		-13.0	48.8	29	5.9		-2.7	14.3	30	5.4	*	10.8	7.9
ND	19	-9.5		-26.5	7.6	28	0.9		-5.0	6.6	29	3.1	**	0.3	5.8
OK	16	40.1		-19.3	106.7	19	-1.2		-5.7	3.5	22	-2.3		-6.0	2.0
SD	12	-12.1	*	-25.5	0.2	21	-3.4		-8.4	1.6	26	1.0		-1.8	3.8
TX	105	8.4		-6.6	23.6	143	-1.3		-3.1	0.7	190	-0.6		-2.0	0.7
WY	10	-14.0		-58.6	33.0	17	-1.1		-10.1	6.3	19	-3.4	**	-6.6	-0.1
Unit	306	4.2		-3.8	12.7	418	-1.5	*	-2.9	0.0	493	-0.5		-1.6	0.5
WESTERN UNIT															
AZ	33	-16.2		-41.0	10.0	57	-6.6	***	-8.8	-4.4	65	-1.9		-4.4	0.5
CA	25	28.9		-16.3	79.3	57	-4.2	***	-6.9	-1.3	72	-4.1	***	-7.1	-1.5
ID	9	-8.7		-82.3	97.8	21	0.0		-5.1	5.0	23	-1.7		-5.7	2.0
NV	11	-48.0	***	-72.7	-23.1	19	-4.4		-10.6	1.9	27	-3.9		-8.0	0.8
OR	9	96.6	*	-18.3	253.9	20	2.9		-2.4	9.1	23	-2.2	**	-4.8	0.0
UT	13	7.3		-45.1	60.1	16	-2.3		-7.8	2.8	16	-3.0		-8.6	1.5
WA	6	91.6		-28.0	208.8	18	0.1		-7.1	7.3	21	-3.5	**	-6.4	-0.1
Unit	106	-4.9		-23.5	15.3	208	-4.8	***	-6.5	-3.1	247	-3.0	***	-4.7	-1.4

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[a] Mean of route trends weighted by land area and population density. The estimated count in the next year is (%/100+1) times the count in the current year where % is the annual change. Note: Extrapolating the estimated trend statistic (% change per year) over time (e.g. 25 years) may exaggerate the total change over the period.

[b] *P<0.1; **P< 0.05; ***P<0.01

[c] Hunt state; see text for details.

Table 2. Breeding population indices[a] based on mourning doves heard along call-count survey routes, 1966-90.

Management	Year																								
unit/state	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
EASTERN UNIT																									
Hunt																									
AL	23.1	20.8	19.1	19.5	19.5	16.2	23.3	20.7	16.2	20.4	20.2	22.2	24.7	23.8	24.5	24.0	25.2	25.0	21.4	27.2	24.8	23.0	24.8	22.1	20.8
DE	2.0	3.8	2.7	0.0	5.6	4.2	3.6	8.1	8.1	10.9	7.2	4.4	7.3	4.9	6.9	8.6	9.2	5.2	13.3	12.7	18.9	15.3	18.1	17.1	9.1
FL	9.0	8.7	7.7	8.4	10.2	8.4	9.8	10.3	12.5	13.9	12.6	13.9	10.3	11.3	10.2	10.1	12.5	14.5	9.1	12.9	15.3	14.2	15.6	14.7	15.0
GA	28.9	23.2	21.8	22.1	28.5	24.7	22.3	23.6	25.0	30.2	24.9	25.7	28.7	25.1	24.1	27.5	29.6	26.4	20.2	27.3	25.4	25.8	26.6	28.8	27.3
IL	20.6	18.2	21.6	18.9	22.4	20.5	21.2	21.4	18.3	27.0	26.8	28.9	22.7	20.0	20.6	23.7	29.0	30.3	24.4	21.4	29.8	29.5	34.7	33.3	33.1
KY	28.5	22.7	23.1	23.9	29.1	27.0	22.9	24.9	29.2	22.0	23.7	22.5	26.5	19.2	16.4	25.5	26.0	18.5	22.8	23.0	20.9	24.7	19.6	27.5	20.1
LA	11.5	11.8	11.0	12.7	8.6	11.4	12.4	9.7	11.1	12.0	11.9	9.6	11.8	9.6	12.9	11.6	14.4	13.1	12.4	10.9	10.0	14.5	10.2	18.7	12.8
MD	20.9	23.3	16.0	17.2	20.9	19.3	19.7	18.8	19.1	12.8	15.9	16.4	15.5	15.9	14.0	14.1	14.5	11.8	11.4	12.5	15.0	12.0	10.8	14.7	7.1
MS	37.9	32.9	28.3	26.2	29.2	30.9	33.7	30.2	25.4	27.3	28.4	28.7	32.4	28.0	26.5	26.0	33.0	28.0	21.0	27.9	27.7	24.3	28.3	27.0	22.7
NC	42.4	33.9	35.5	25.4	34.8	32.5	30.2	37.9	26.9	26.0	26.0	30.8	26.7	24.7	28.2	24.8	25.6	25.3	25.8	24.5	25.7	27.5	25.1	27.5	23.2
PA	10.2	10.6	10.2	9.7	6.4	6.7	9.6	6.4	9.2	6.6	6.7	6.0	6.4	6.8	9.4	9.9	10.1	9.7	8.9	9.2	9.8	11.2	7.7	9.8	10.1
RI	6.6	7.4	6.9	10.2	3.7	9.9	7.7	6.6	8.3	9.0	9.7	6.9	10.7	12.9	11.2	11.9	13.7	9.0	7.5	9.2	8.5	11.1	10.7	8.2	11.1
SC	31.4	34.1	35.1	35.0	32.5	29.4	26.2	30.7	28.7	28.1	27.9	23.8	31.2	27.7	33.7	33.0	34.9	33.5	29.8	30.3	26.0	36.8	29.0	29.2	31.1
TN	31.5	22.1	24.3	23.2	28.8	21.1	28.5	20.7	22.7	21.5	20.7	24.8	27.5	19.4	21.3	18.9	24.8	18.5	15.9	20.0	15.3	18.5	18.6	17.7	18.3
VA	27.4	23.0	22.3	20.6	25.4	23.1	15.1	17.1	20.8	23.6	22.1	29.6	21.6	21.2	19.1	17.7	17.9	19.3	18.1	16.1	14.2	15.0	16.1	15.4	14.3
WV	4.3	3.8	4.0	4.8	5.2	4.6	6.4	3.5	4.0	2.3	5.0	5.1	6.6	7.4	7.9	7.0	6.7	6.4	6.2	7.1	7.0	7.4	9.0	9.0	11.4
Subunit	21.9	19.7	19.1	18.8	20.1	18.6	19.9	18.9	18.9	19.4	19.5	20.3	21.2	19.0	19.0	20.0	22.5	20.7	18.2	20.3	20.0	21.3	20.7	22.2	20.2
Nonhunt																									
CT	2.4	3.7	3.9	1.8	7.5	5.7	5.4	4.4	4.8	8.6	9.2	9.5	11.9	12.7	10.7	15.9	11.6	9.3	11.1	16.4	36.4	17.7	13.9	27.5	25.3
IN[b]	40.2	36.4	36.7	34.4	32.8	43.5	37.8	33.6	32.1	32.9	32.5	36.8	20.5	21.2	26.4	30.5	21.3	18.5	19.9	17.3	23.1	22.7	27.1	22.5	24.8
ME	1.7	1.7	3.2	2.8	1.9	2.4	-0.1	-0.6	0.9	0.9	0.9	8.4	7.0	4.3	8.1	7.8	9.1	7.8	6.9	9.2	9.5	6.6	8.4	12.7	9.0
MA	9.6	18.9	5.8	5.0	12.3	8.1	12.1	13.9	10.7	10.7	6.7	10.4	12.2	7.4	9.9	10.9	10.2	9.1	9.0	9.7	9.6	8.4	10.0	9.0	7.9
MI	12.5	13.2	8.9	9.5	9.1	14.0	13.3	10.5	10.3	10.5	11.8	10.7	11.1	7.7	12.7	12.6	11.2	9.7	10.8	11.0	13.8	12.0	13.9	16.0	12.6
NH	5.5	3.4	3.4	2.9	4.4	4.4	4.3	6.1	4.6	3.4	3.7	4.1	4.3	3.7	3.2	5.0	3.2	6.3	3.5	3.3	5.4	5.8	3.8	2.9	5.0
NJ	19.2	15.7	20.7	19.0	24.8	23.1	24.7	22.1	19.5	14.7	17.4	19.2	15.4	16.4	14.9	14.1	15.2	17.6	11.7	13.1	14.6	12.4	12.1	14.4	13.0
NY	6.9	6.7	6.5	6.3	7.5	8.8	7.3	7.3	7.7	13.3	8.6	8.7	8.7	6.6	11.1	10.9	10.4	9.5	9.2	8.9	7.5	8.9	7.4	11.8	10.0
OH	23.5	21.5	19.7	21.9	23.7	22.4	23.8	18.6	22.7	30.2	25.0	23.9	12.1	12.0	14.6	17.7	16.6	17.5	16.4	14.8	15.0	16.4	18.7	18.4	16.0
VT	--	--	--	--	--	--	--	--	--	--	2.3	5.1	3.2	8.6	8.4	9.7	4.8	4.8	6.7	8.0	6.3	7.9	7.2	7.3	10.2
WI	10.9	14.9	13.5	11.1	11.0	14.1	15.5	12.9	11.7	13.9	15.0	16.3	10.8	10.9	17.1	19.3	11.4	13.5	11.8	11.7	12.4	10.7	18.8	17.6	15.6
Subunit	14.9	15.3	13.4	12.4	13.6	16.0	16.2	13.9	13.2	15.5	15.3	15.8	10.6	9.7	12.9	14.4	12.4	12.4	11.5	11.5	12.1	11.7	12.8	13.6	13.0
Unit	19.4	18.1	17.1	16.6	17.8	17.6	18.5	17.1	16.9	18.0	18.2	19.0	17.1	15.4	17.5	18.3	18.7	17.8	16.0	17.2	17.3	17.9	18.1	19.3	17.8
CENTRAL UNIT																									
AR	28.6	27.7	27.3	26.0	25.9	26.1	29.4	27.4	23.3	21.4	25.7	21.0	15.7	13.1	21.4	21.7	22.2	17.7	13.6	13.7	13.4	15.7	15.2	18.8	15.8
CO	12.7	16.1	12.6	14.6	19.0	13.9	19.8	14.9	20.6	16.7	20.4	22.5	26.8	23.0	27.2	32.1	31.8	19.7	28.0	30.1	29.9	33.6	32.0	35.3	34.9
IA	33.9	30.5	32.7	285	20.8	25.6	32.3	30.5	23.7	22.2	27.5	21.2	23.8	20.2	27.0	29.7	21.3	16.7	21.8	24.2	22.1	20.7	27.8	25.7	30.4
KS	47.4	46.3	51.8	49.2	45.6	47.5	54.1	46.8	46.4	45.0	49.6	47.8	37.3	52.5	59.6	54.9	52.9	62.0	48.0	62.7	43.8	47.1	55.4	50.7	45.9
MN	22.9	21.8	20.9	22.4	16.3	21.5	24.9	20.0	22.3	24.5	24.2	27.5	24.2	26.6	27.8	27.2	21.5	22.3	17.0	19.8	19.7	23.3	25.0	22.3	18.4
MO	44.8	42.1	52.0	30.9	42.5	35.4	47.3	36.0	30.4	34.1	30.2	34.2	22.6	21.2	31.3	27.5	24.6	24.2	21.2	20.2	21.7	23.6	24.0	23.4	20.0
MT	22.2	19.9	17.4	18.2	14.9	21.3	16.2	12.1	13.8	18.8	15.1	18.5	17.6	18.2	16.9	16.0	19.2	16.4	12.5	16.1	16.9	14.5	13.7	17.1	16.3
NE	41.9	37.6	47.6	46.4	45.0	43.5	42.1	40.8	41.8	40.5	45.0	44.6	38.2	39.5	50.9	48.6	46.4	43.8	41.5	43.8	35.1	35.2	35.6	37.5	38.1
NM	10.2	7.3	11.1	9.1	8.8	8.3	11.2	7.9	9.8	12.9	13.4	12.2	13.1	9.7	15.8	15.7	13.5	17.2	19.7	17.7	21.6	25.9	21.4	22.9	23.9
ND	26.6	26.8	36.6	29.7	27.5	30.1	30.2	35.4	35.1	28.2	45.7	38.6	42.5	40.4	47.1	48.4	46.8	45.2	35.9	47.2.	50.0	55.0	53.5	57.5	55.4
OK	26.9	32.3	39.6	39.7	26.7	23.6	31.1	27.5	28.0	24.1	27.6	35.4	25.4	25.5	24.8	25.2	27.6	26.8	19.8	19.6	21.1	22.5	21.4	14.9	19.8
SD	44.9	28.8	38.0	34.7	42.2	37.0	37.2	39.9	49.1	42.3	45.5	40.6	45.7	43.9	45.2	40.6	48.9	46.0	49.1	45.7	44.2	38.9	46.3	50.5	50.2
TX	25.4	20.2	22.2	19.2	20.4	19.3	25.9	21.2	22.1	19.8	19.8	18.8	19.3	23.5	22.9	20.6	20.0	18.8	18.1	19.1	21.0	20.4	21.2	16.5	18.2
WY	19.8	20.2	9.9	18.0	19.7	9.8	13.1	15.1	18.2	15.7	15.5	11.4	14.2	11.4	10.4	11.9	13.0	9.8	7.9	9.8	12.3	9.8	6.3	8.2	7.9
Unit	28.2	25.5	28.5	25.9	25.5	24.8	28.7	25.0	26.0	24.6	26.1	25.1	24.1	24.5	27.5	26.5	25.6	23.8	22.1	23.8	24.3	24.5	24.7	22.9	23.4
WESTERN UNIT																									
AZ	28.0	29.8	25.7	30.3	30.9	20.6	21.3	27.5	23.8	24.0	26.5	22.1	22.6	23.9	20.2	22.5	24.4	19.7	23.7	19.6	21.7	15.1	16.7	21.3	16.2
CA	29.8	28.5	28.0	25.3	25.3	20.1	24.2	19.9	21.3	19.1	21.2	18.1	14.7	12.8	18.4	17.0	17.6	11.7	16.3	11.5	13.6	10.0	13.3	9.7	11.7
ID	15.2	16.0	14.7	15.4	14.6	11.7	11.3	13.1	11.4	9.4	14.8	18.3	9.8	9.9	10.3	11.6	11.5	9.7	11.4	10.7	7.2	7.6	12.1	9.9	12.7
NV	8.2	6.8	16.5	12.2	8.5	5.3	6.5	4.6	7.1	4.1	6.9	6.7	4.1	6.2	9.1	6.3	3.9	3.6	3.5	4.7	3.1	3.6	4.8	4.3	2.9
OR	14.5	10.1	10.8	11.8	8.4	7.4	6.4	8.2	11.6	9.6	9.1	10.6	5.5	5.6	9.1	7.5	7.0	5.6	6.8	8.1	6.3	6.3	6.6	5.8	7.5
UT	18.7	27.2	15.3	15.2	15.9	23.2	13.0	11.7	13.7	15.3	16.9	19.3	8.6	10.9	13.1	17.6	10.3	10.4	12.6	7.8	11.7	9.7	10.8	11.6	9.8
WA	10.3	13.2	12.8	10.3	11.4	11.9	9.3	8.0	9.4	10.2	10.1	11.2	7.2	9.6	6.3	7.8	7.3	5.7	4.9	6.6	8.2	6.1	6.1	5.5	5.6
Unit	19.4	19.3	19.2	18.8	17.9	14.3	14.3	14.3	15.2	13.8	16.1	15.3	11.0	11.8	13.3	13.5	12.4	9.8	11.6	10.3	10.4	8.6	10.3	9.7	9.4

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[a] Annual indices are defined as the predicted value from the trend analysis plus the deviation from the expected value in a year. A large, but not significant change based upon a small sample size will produce exaggerated indices over the 24-year period. For example, the indices for Maine and Connecticut are larger than actual population densities in 1989.

[b] Hunt state; see text for details.

Table 3. Trends (% change[a] per year as determined by linear regression) in number of mourning doves heard along call-count survey routes, 1966-90.

Geographic reference area	2 year (1989-90)					10 year (1981-90)					25 year (1966-90)				
	N	% Change		95% CI		N	% Change		95% CI		N	% Change		95% CI	
CENTRAL UNIT															
West CMU[b]	62	5.8		-9.9	21.0	87	0.6		-3.8	5.2	96	1.2		-1.2	3.7
Mid CMU[d]	196	4.9		-4.2	13.9	264	-1.6	**[c]	-3.1	-0.1	324	-0.3		-1.4	0.7
East CMU[e]	48	-0.3		-14.3	13.9	67	-1.4		-3.0	0.4	73	-1.7	***	-2.9	-0.4
Unit[f]	306	4.2		-3.8	12.7	418	-1.5	*	-2.9	0.0	493	-0.5		-1.6	0.5
WESTERN UNIT															
Coastal WMU[g]	40	31.3		-13.5	85.5	95	-3.6	***	-6.1	-1.0	116	-4.0	***	-6.7	-1.5
Interior WMU[h]	66	-17.8	*	-35.6	0.9	113	-5.7	***	-7.9	-3.5	131	-2.2	**	-4.2	-0.2
Unit[f]	106	-4.9		-23.5	15.3	208	-4.8	***	-6.5	-3.1	247	-3.0	***	-4.7	-1.4

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[a] Mean of route trends weighted by land area and population density. The estimated count in the next year is (%/100+1) times the count in the current year where % is the annual change. Note: Extrapolating the estimated trend statistic (% change per year) over time (e.g. 24 years) may exaggerate the total change over the period.

[b] West CMU: MT, WY, CO, and NM

[c] *P<0.1; **P< 0.05; ***P<0.01

[d] Mid CMU: ND, SD, NE, KS, OK, and TX.

[e] East CMU: MN, IA, MO, and AR.

[f] These data are also presented in Table 2, but are included here to facilitate comparison

[g] Coastal WMU: WA, OR, and CA.

[h] Interior WMU: ID, NV, UT, and AZ.

END

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